I N S E C T S I N R E L A T I O N

T O

N A T I O N A L D E F E N S E

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Circular 4

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FOOD INSECTS

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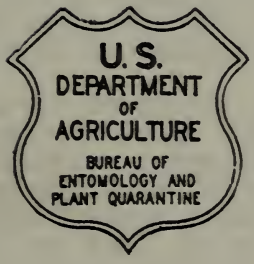


March 1941

INSECTS IN RELATION

TO

NATIONAL DEFENSE

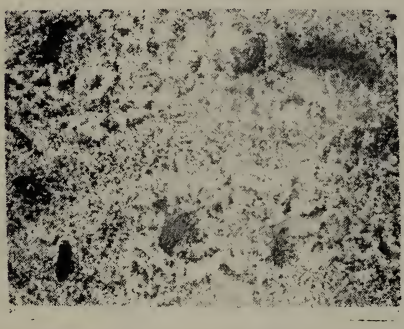
Circular 4 - Food Insects

A number of very small black or brown beetles, weevils, small whitish worms, and brown or gray moths are sometimes found in grain, flour, meal, rice, oatmeal, breakfast cereals, dry beans, dry peas, and dried fruits. The most common ones are the flour beetles, saw-toothed grain beetle, granary or rice weevil, cadelle, Mediterranean flour moth, Angoumois grain moth, Indian meal moth, mites, and bean or pea weevils. Most of these occur in all temperate and tropical parts of the world and may become serious pests in grains or dry food products that are stored for any great length of time under conditions favorable to their development. An idea of the size and appearance of these insects and their work may be obtained from the accompanying illustrations. All of these insects have four distinct stages--adult, egg, larva (grub or worm) and pupa. Mites have but two, the egg which is similar to that of insects, and the active mite, the newly hatched form of which resembles the adult except that it is smaller.

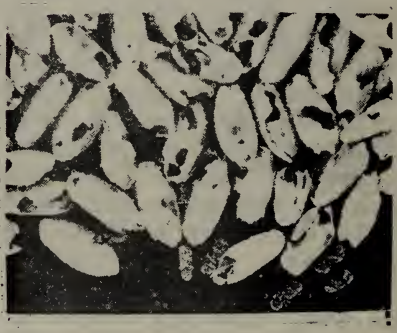
Many of the grain infesting insects deposit their eggs inside the kernels of wheat and corn where they cannot be detected by external inspection. The eggs of the smallest beetles commonly found infesting flour--the flat grain beetle for instance--are so minute as to be almost invisible to the unaided eye. It would take 150 of them laid side by side to extend one inch. For this reason these eggs and those of other species can be excluded from finished flour only by the use of the finest, 10 XX, bolting cloth. As the life of such cloth is limited and as holes in it may escape the immediate attention of the miller, there is always a possibility that flour may contain some slight insect infestation when produced even by the best managed mills. This emphasizes the desirability of prompt consumption of flour after purchase or else its storage at temperature not to exceed 50°F. until used.

Mediterranean Flour Moth in Flour

Indian Meal Moth in Corn Meal



Flour Beetle in Flour



Lesser Grain Borer and Damaged Wheat

Rice Weevil in Rice

Weevils and Beetles from Stored Products

From 100 to 500 or more eggs may be deposited by a single flour infesting insect under summer temperatures. These then hatch in a few days and may become mature insects, ready to reproduce within 30 days thereafter. Their rate of reproduction under summer temperatures is so rapid that stored grains or cereals may be rendered unfit for human consumption within a comparatively brief period. The most practical and readily applied measures of control are preventive rather than remedial.

PROTECTIVE MEASURES

Purchase of Insect-free Products

The first essential in avoiding trouble from insects is to make certain that the food products are not infested when purchased and put into storage. Purchasing contracts should contain the stipulation that the food materials shall be free from insect infestation. Inspection by competent inspectors of all food processing plants handling large contracts should be required. Receiving officers should be required to inspect food commodities which are subject to infestation and make sure that they are delivered in an insect-free condition so far as can be determined by a reasonably careful inspection. If infestations are detected the commodities should be rejected.

The small size of the insects, especially when they are in the egg stage, makes it impossible to rely on inspection alone. Therefore, since common species may be distributed in many ways, it is important that adequate provision be taken to protect susceptible food products from infestation.

Long Storage Undesirable

Insect damage to stored food is aggravated by long storage. Infestations that are small develop to tremendous proportions after a few generations of insects. Many of the common food infesting insects complete a generation in about 6 weeks under summer temperatures. It is desirable, therefore, that the supply of susceptible stocks be held as low as practicable and that contracts be arranged so that fresh supplies are delivered at frequent intervals rather than in large lots. Food supplies subject to infestation should be

used in the order of their receipt. Old stocks are not only likely to suffer damage from insect attack but serve as a source of infestation for other products stored nearby, hence they should always be used first.

Sanitation

Scrupulous cleanliness in all depots where food supplies are stored is essential. Small accumulations of food material in cracks and crevices may provide a way for insects to persist. Broken containers and accumulations of foodstuffs that may occur on the floors should be promptly and completely removed, since insects are attracted by such conditions and will breed rapidly in any exposed food supply or deposits of food materials in corners or cracks that are left undisturbed. All cereal products intended for human consumption should be stored separately from animal feeds. The insects almost always present in these feeds will quickly spread to any food products stored near them.

Storage in clean warehouses of concrete or brick construction is preferable. They offer fewer places for insects to hide and floury dust to accumulate, can be cleaned more thoroughly, and due to their tighter construction can be fumigated more effectively if fumigation becomes necessary. If wooden structures are used, concrete floors are desirable since they can be more easily cleaned and will harbor fewer insects.

Infested food supplies are unfit for human consumption and are sources from which insects spread to other supplies stored near them. They should therefore be disposed of as soon as discovered.

Heat

The insects infesting dry food products can be killed by exposure to dry heat. A temperature of 140°F. for at least 5 minutes, or 120°F. or more for at least 5 hours will kill most of them. With careful control of temperatures, incipient infestations can thus be suppressed without injury to these materials by completely warming them through and holding them at these temperatures for the periods specified, and then storing them in tight containers or in a clean place away from other supplies from which they may become reinfested.

Cold Storage

The insect pests of stored food supplies are for the most part quite susceptible to exposure to low temperatures and are not active or able to breed at temperatures of 50°F. or below. Insect troubles in unheated warehouses are not likely to be severe except during the summer and fall in temperate climates, although in warm climates trouble may be expected the year around.

In sections of the country having cold winters advantage should be taken of the low outside temperatures to cool down storage warehouses housing food materials that will not be damaged by freezing. Where artificial cold storage facilities are available they can be utilized to keep susceptible foods safely or to kill out or prevent the increase of small infestations that may exist in certain supplies. The use of cold storage wherever it can be made available for this purpose is recommended.

Dryness

Insects infesting dry food products do not thrive and multiply in food materials that have a moisture content of 10 percent or less. For storage purposes it is therefore desirable to obtain staple foods having as low a moisture content as is practicable and to store them under conditions that will prevent them from absorbing additional moisture.

Tight Containers

Flour and other food products may become infested while in transit or temporary storage. Most of this infestation can be prevented by the packaging of these products in tightly sealed cartons, multi-walled paper bags or fabric bags with paper liners. Paper bags or paper liners should be closed with a strip of rubber latex tape in addition to sewing or stapling. Certain insects, such as the cadelle, can bore through sealed cardboard and paper containers, thus providing for the entrance of other insects. However, it is not likely that a very large percentage of such packages will be damaged by the cadelle or other boring insects unless stored for long periods in unsanitary conditions, hence these types of packages will afford considerable protection from insect damage.

Although the insects inhabiting cereal products require very little air and can breed in containers that are not completely air tight, experiments have shown that the activity of most species is quickly stopped if the materials are enclosed in airtight well-filled packages from which most of the air has been excluded. Where storage for long periods is necessary and exposure to infestation cannot otherwise be avoided, storage in hermetically sealed metal containers, such as the steel drums sometimes used for flour by the Navy, may be utilized to advantage.

Fumigation

It may be necessary at times to eradicate insect infestation from storage warehouses, or to treat individual lots of infested supplies by means of fumigation. Fumigation should be done only by specially trained experienced personnel. Information regarding such control measures is given in Circular 22.

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